

Airports, Seaports, and Warehouses: Blending CMAQ and TROPOMI

Jen Kaiser | Georgia Institute of Technology

Ted Russell

HAQAST PI



Abi Lawal

Now at UConn



Nash Skipper

Now at EPA



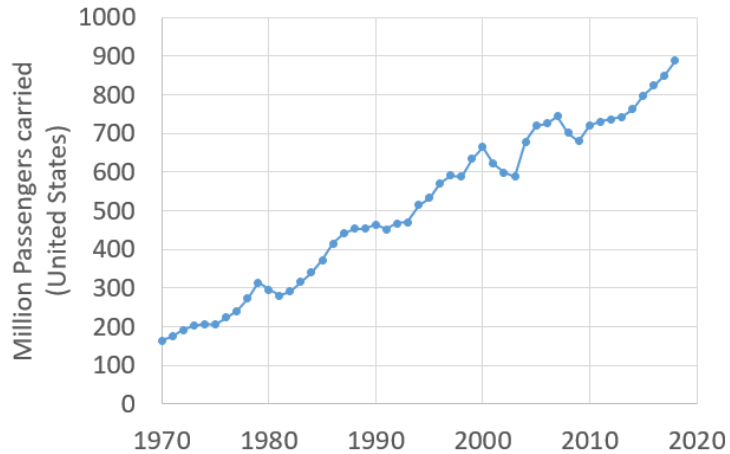
Aryiana Moore

PhD Student



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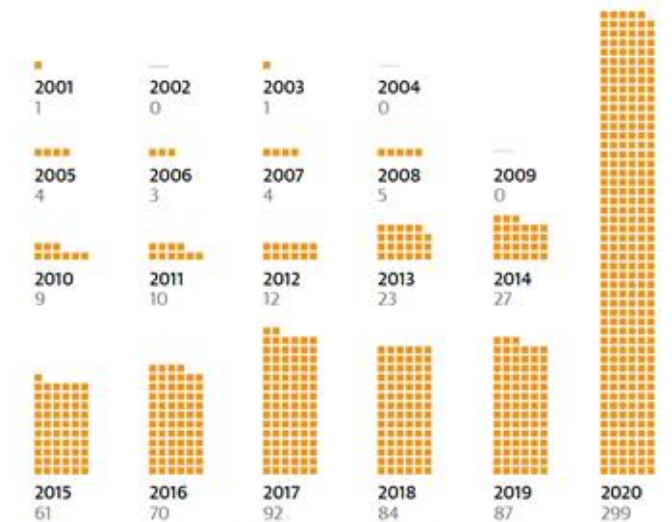
Increasing **air travel**



New rules for **cargo ships**

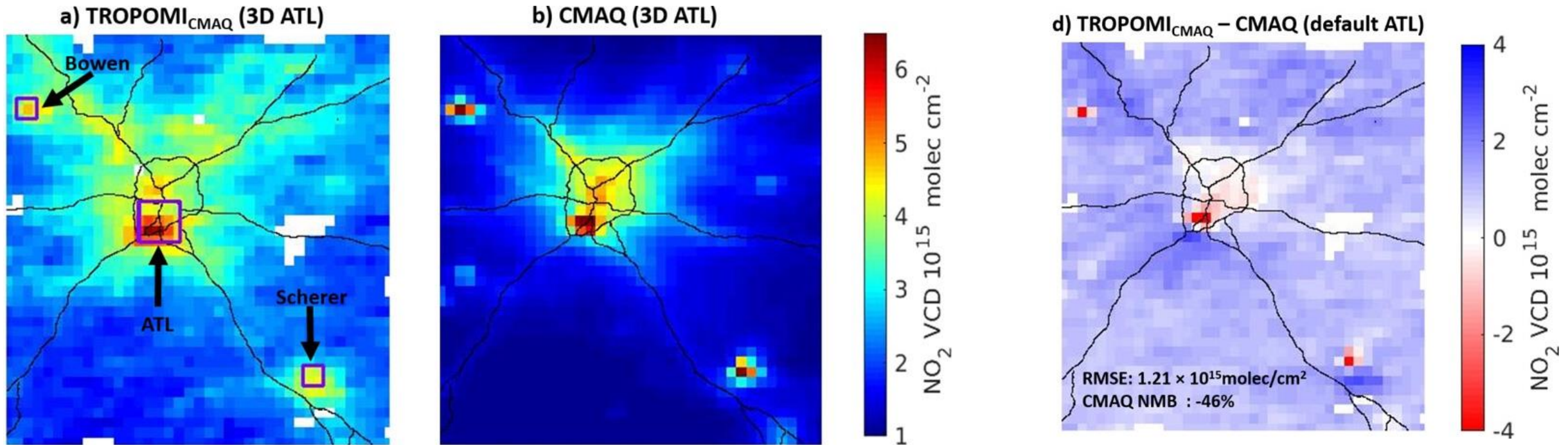


Growing **e-commerce**



TROPOMI NO_2 gives insight into **rapidly changing sources**

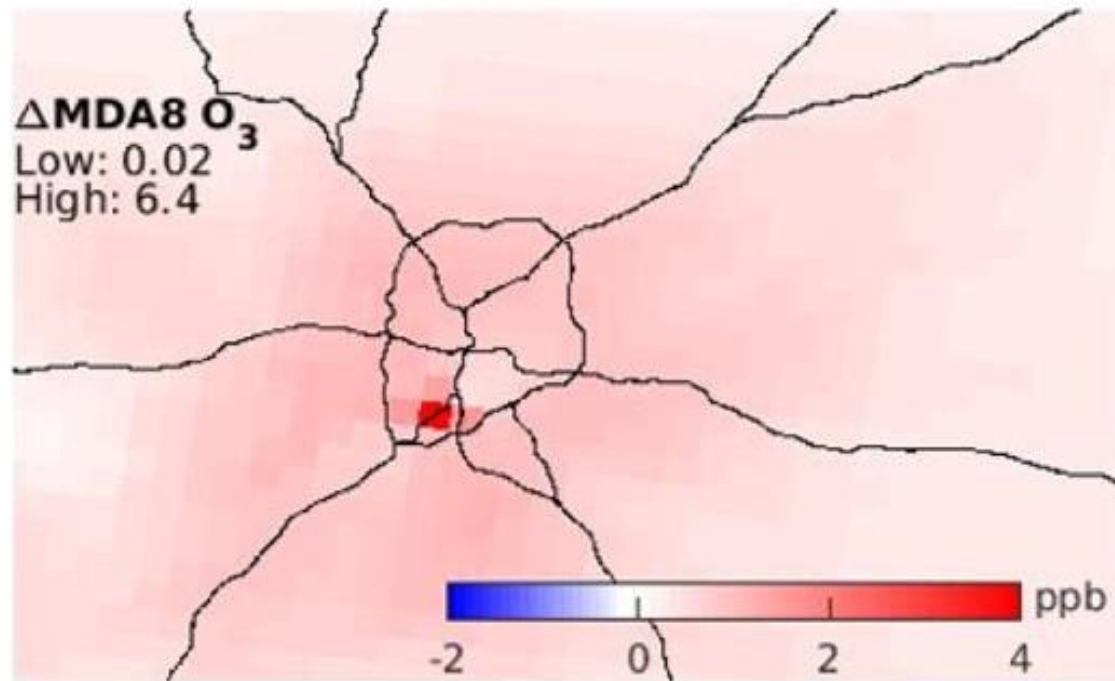
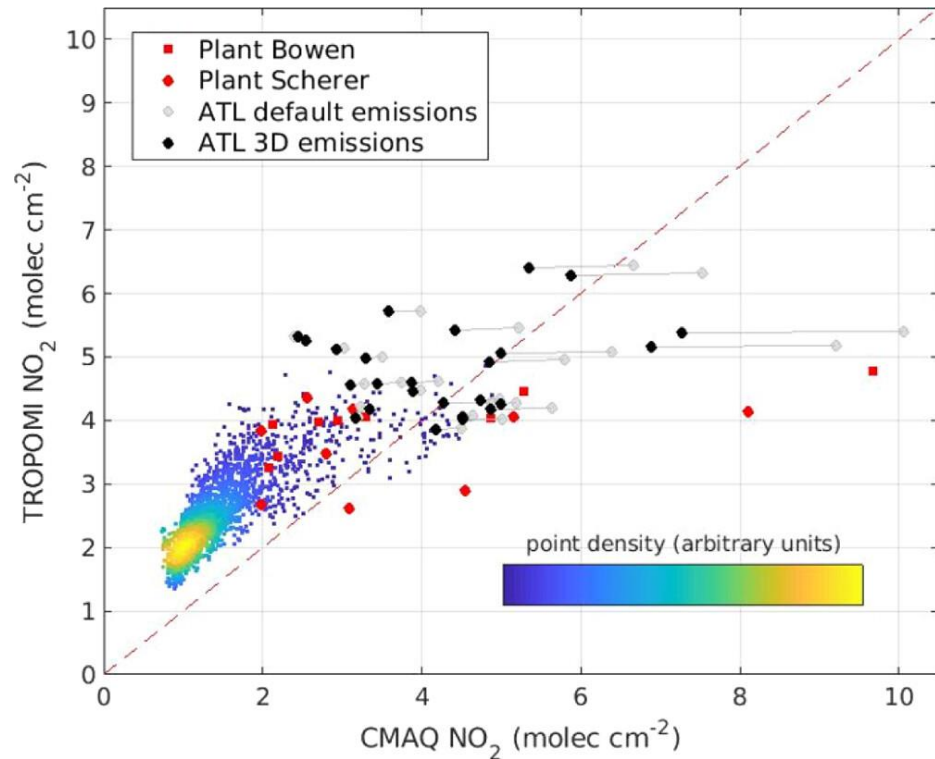
TROPOMI NO₂ as a check on our modeling of aviation-related emissions



Lawal et al., EST, 2022

- Typical pattern: CMAQ “hot spots” are brighter than TROPOMI hotspots
- This work: Putting emissions where planes fly leads to better of CMAQ/TROPOMI agreement
- Ongoing work: influence of rapid dilution in CMAQ (artificially inflates NO₂ lifetimes)

TROPOMI NO₂ as a check on our modeling of aviation-related emissions



Lawal et al., EST, 2022

Placing emission in more realistic patterns :

- (1) Places CMAQ/TROPOMI in more uniform agreement
- (2) Increases modeled MDA8 ozone

More observational constraints needed!
Work ongoing.

TROPOMI NO₂ as a check on our modeling of aviation-related emissions

Ongoing work: Confirm new CMAQ emissions and AMF with in-situ observations



Pandoras: Ground-based remote sensing of column; profiles



In-situ: Surface concentrations, low cost sensor comparison

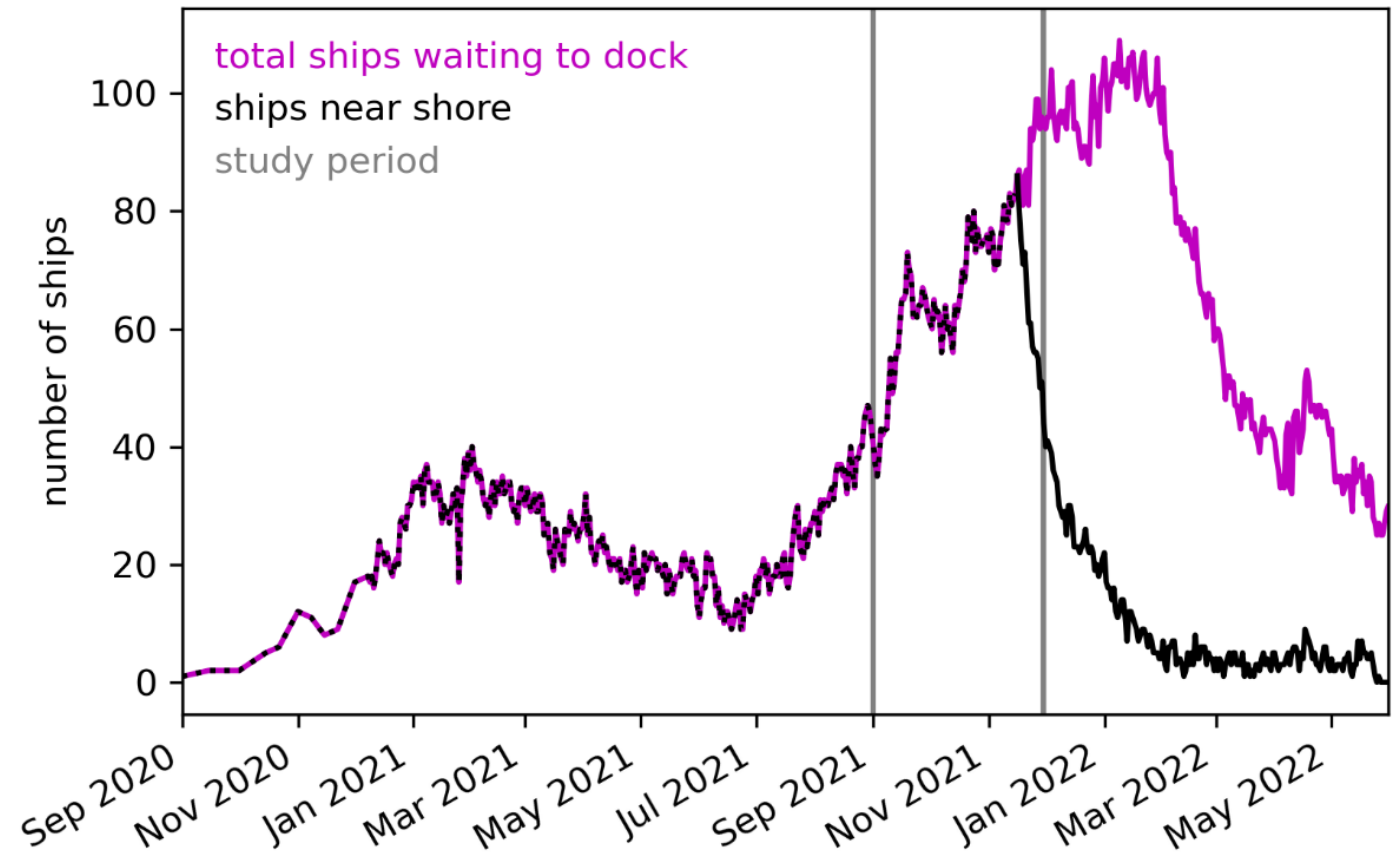
Ships idling off of CA coast: Blending TROPOMI and CMAQ to control for meteorological changes

As 100 ships idle offshore, California communities see rise in toxic pollutants

"We can't forget that when we're talking about air pollution and air quality, this comes down to people's longevity."

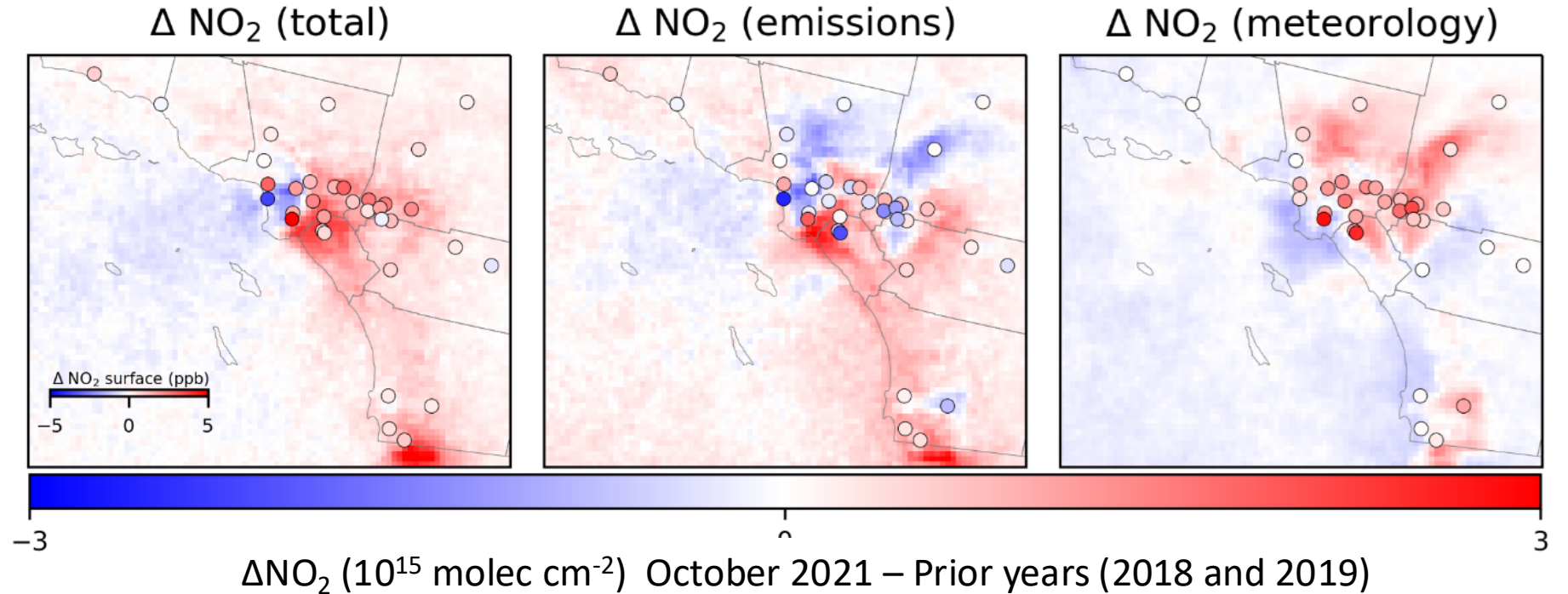


Container ships are anchored by the ports of Long Beach and Los Angeles as they wait to offload on Sept. 20, 2021 near Los Angeles.
Mario Tama / Getty Images file



Skipper et al., in preparation

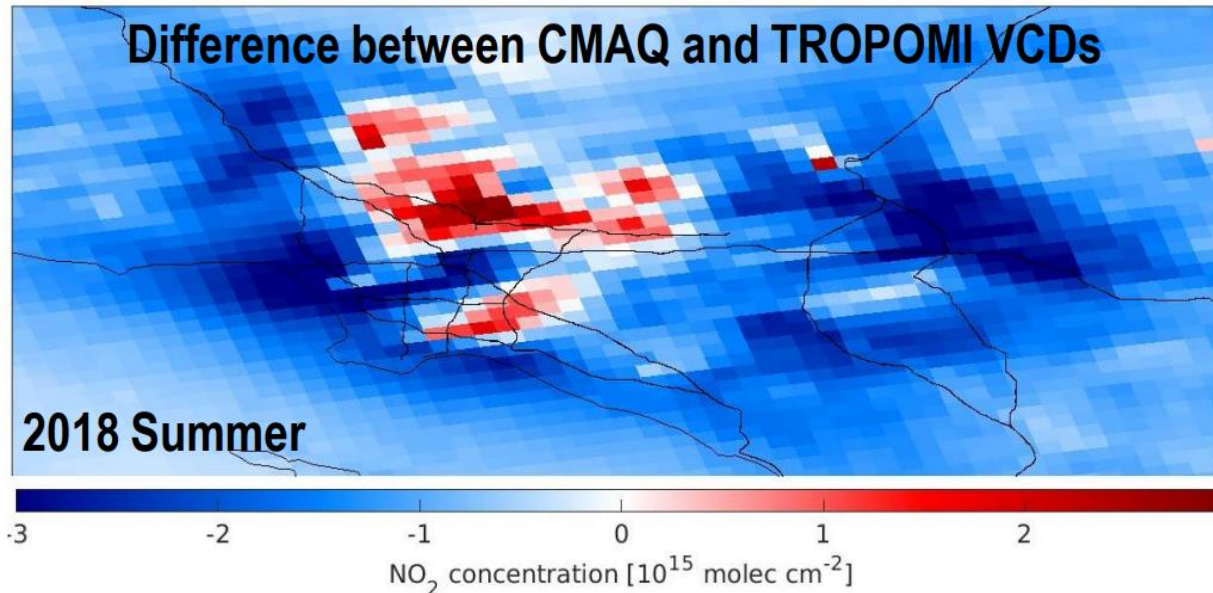
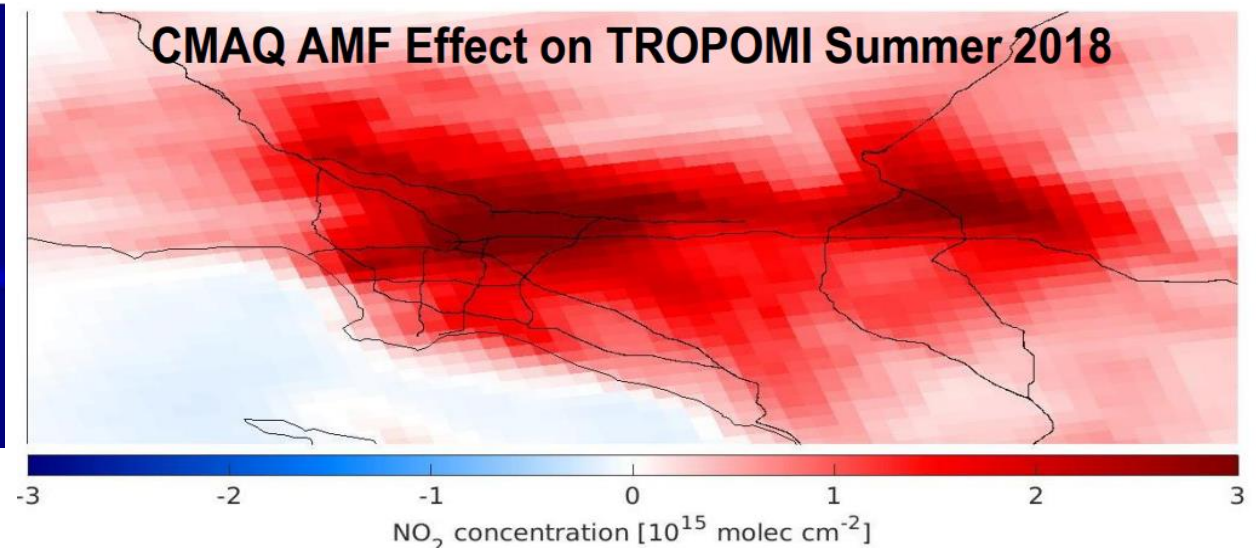
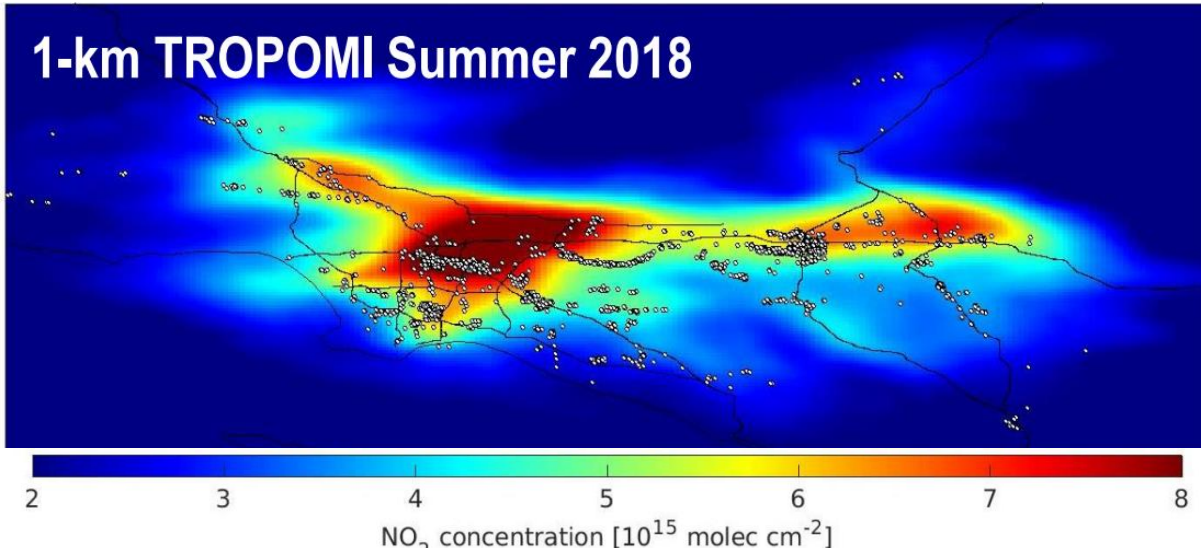
Ships idling off of CA coast: Blending TROPOMI and CMAQ to control for meteorological changes



Skipper et al., in preparation

- Meteorology decreased NO_2 in coastal areas but increased NO_2 inland.
- Emission-related NO_2 increased by 28% compared to the baseline near the ports.
- In Central LA emission reductions led to a 10% decrease in NO_2 .

Warehousing: a difficult bump on top of the city



- Hotspots in TROPOMI correlated with warehouses, but also general shipping/travel activity.
- ~40% **increase in TROPOMI NO₂** when high resolution CMAQ profiles applied for AMF calculation
- **TROPOMI > CMAQ (blue)** except over LA
- How should emissions be incorporated into CMAQ? See Aryiana Moore's poster!

Take-aways

- 1.) **Airports**: TROPOMI NO₂ can be used as a check on emissions, but on-ground observations needed
- 2.) **Seaports**: CMAQ allows us to separate out independent roles of meteorology and emissions on observed NO₂
- 3.) **Warehouses**: Not all emissions sources are easily detected/separable (yet!), CMAQ AMF makes large difference.